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(72) Inventor: **Winter, Marco**  
**30173 Hannover (DE)**

(74) Representative: **Hartnack, Wolfgang, Dipl.-Ing.**  
**Deutsche Thomson-Brandt GmbH**  
**European Patent Operations**  
**Karl-Wiechert-Allee 74**  
**30625 Hannover (DE)**

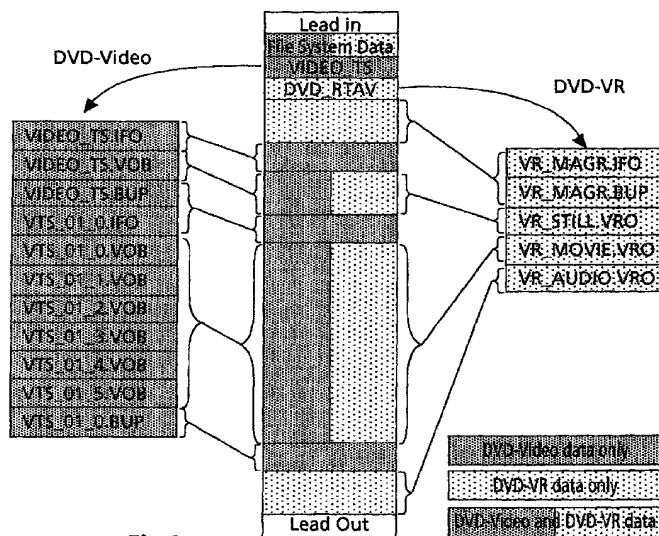
(71) Applicant: **DEUTSCHE THOMSON-BRANDT  
GMBH**  
**78048 Villingen-Schwenningen (DE)**

(54) **Method and apparatus for evaluating for the purpose of decoding a bitstream having a data structure fulfilling the requirements of two different data structure standards, and storage medium containing such bitstream**

(57) There are different types of DVD systems, e.g. the replay-only DVD-Video system and the re-recordable DVD-VR system. A DVD-VR type disc containing a DVD-VR type bitstream is to be replayed on a DVD-VR type recorder or player. However, it is also possible to record a DVD-Video type bitstream on a DVD-VR type disc in a DVD-VR type recorder, for replay of that disc in a DVD-Video type player. Because the DVD-VR and DVD-Video formats are different and contain different content they are not compatible with each other and a disc containing a bitstream of the one type can not be replayed on a player of the other type, a user must make a choice of which type of bitstream recording on a disc.

One solution to this problem would be to record a separate disc for each type of bitstream.

According to the invention a special type of bitstream is assembled and recorded on a disc that can be replayed on both types of players. This special type of bitstream is compatible with the DVD-Video system as well as the DVD-VR system. For both systems, corresponding additional files are added to their specific directories, but the resulting bitstream for both system types represents the same identical file on the disc. A disc containing a bitstream having such data structure can be replayed on both, DVD-VR and DVD-Video players.



**Fig.1**

## Description

**[0001]** The invention relates to a method and to an apparatus for evaluating for the purpose of decoding a bitstream having a data structure fulfilling the requirements of two different data structure standards, and relates to a compatible storage medium containing such bitstream and to a method for compatibly assembling such bitstream.

## Background

**[0002]** There are different types of DVD (digital versatile disc) systems, for instance the replay-only DVD-Video system and the re-recordable DVD-VR system. DVD-Video is specified in: DVD Specification for Read-Only Disc, Part 3, Video Specifications, Version 1.0, August 1996.

DVD-VR is specified in: DVD Specification for Rewritable/Re-recordable Discs, Part 3, Video Recording, Version 1.0, September 1999.

The corresponding bitstreams have different formats and different content.

## Invention

**[0003]** A DVD-VR type disc containing a DVD-VR type bitstream is to be replayed on a DVD-VR type recorder or player. However, it is also possible to record a DVD-Video type bitstream on a DVD-VR type disc in a DVD-VR type recorder, for replay of that disc in a DVD-Video type player.

Because the DVD-VR and DVD-Video formats are not compatible with each other and a disc containing a bitstream of the one type can not be replayed on a player of the other type, a user must make a choice of which type of bitstream recording on a disc.

One solution to this problem would be to record a separate disc for each type of bitstream.

**[0004]** The problem to be solved by the invention is to make the required processing easier in order to free a user from the decision about which type of bitstream is to be recorded. This problem is solved by the method disclosed in claim 1. An apparatus that utilises this method is disclosed in claim 7. A storage medium containing a corresponding bitstream is disclosed in claim 11.

**[0005]** According to the invention a special type of bitstream is assembled and recorded on a disc that can be replayed on both types of players. This special type of bitstream is compatible with the DVD-Video system as well as the DVD-VR system. For both systems, corresponding additional files are added to their specific directories, but the resulting bitstream for both system types represents the same identical file on the disc.

A disc containing a bitstream having the inventive data structure can be replayed by both, DVD-VR and DVD-Video players. Even first-generation DVD players can replay such discs.

**[0006]** In principle, the inventive method is suited for evaluating for the purpose of decoding a bitstream having a data structure fulfilling the requirements of a first data structure standard, the data of which bitstream include first main overhead data and multiple data units, each data unit containing first data unit overhead data according to said first data structure standard and encoded video data and encoded or non-encoded audio data, wherein:

- said bitstream additionally includes second main overhead data such that said data structure of said bitstream fulfils also the requirements of a second data structure standard that is different from said first data structure standard;
- said data units additionally contain second data unit overhead data according to said second data structure standard;
- said encoded video data and said encoded or non-encoded audio data are common to said first and second data structure standards;
- when inputting said bitstream to a device operating on the basis of said first data structure standard, evaluating said first main overhead data and said first data unit overhead data of said data units, and decoding said encoded video data and decoding or processing, respectively, said encoded or non-encoded audio data, but not evaluating said second main overhead data and said second data unit overhead data of said multiple data units, or
- when inputting said bitstream to a device operating on the basis of said second data structure standard, evaluating said second main overhead data and said second data unit overhead data of said data units, and decoding said encoded video data and decoding or processing, respectively, said encoded or non-encoded audio data, but not evaluating said first main overhead data and said first data unit overhead data of said multiple data units.

**[0007]** Advantageous additional embodiments of the inventive method are disclosed in the respective dependent claims.

**[0008]** In principle the inventive apparatus is suited for evaluating for the purpose of decoding a bitstream having a data structure fulfilling the requirements of a first data structure standard, the data of which bitstream include first main overhead data and multiple data units, each data unit containing first data unit overhead data according to said first data structure standard and encoded video data and encoded or non-encoded audio data, wherein said apparatus operates on the basis of said first data structure standard and wherein:

- said bitstream additionally includes second main overhead data such that said data structure of said bitstream fulfils also the requirements of a second data structure standard that is different from said

- first data structure standard;
- said data units additionally contain second data unit overhead data according to said second data structure standard;
- said encoded video data and said encoded or non-encoded audio data are common to said first and second data structure standards,

and wherein said apparatus includes:

- means for inputting said bitstream;
- means for evaluating said first main overhead data and said first data unit overhead data of said data units, and for decoding said encoded video data and decoding or processing, respectively, said encoded or non-encoded audio data, but not evaluating said second main overhead data and said second data unit overhead data of said multiple data units.

**[0009]** Either, the first data structure standard can be the DVD-Video standard and the second data structure standard the DVD\_VR standard, or, the first data structure standard can be the DVD\_VR standard and the second data structure standard the DVD-Video standard.

**[0010]** Advantageous additional embodiments of the inventive apparatus are disclosed in the respective dependent claims.

#### Drawings

**[0011]** Exemplary embodiments of the invention are described with reference to the accompanying drawings, which show in:

- Fig. 1 inventive data structure for a DVD-VR disc storing DVD-Video and DVD-VR data;
- Fig. 2 structure of a bitstream on a disc according to Fig. 1;
- Fig. 3 different structure of a bitstream for a disc according to Fig. 1;
- Fig. 4 simplified block diagram of a DVD-Video or DVD-VR player.

#### Exemplary embodiments

**[0012]** As shown in Fig. 1, following Lead\_In and File\_Systems\_Data two additional directories are inserted into the DVD-VR/ Video root directory: VIDEO\_TS for DVD-Video and DVD\_RTAV for DVD-VR.

**[0013]** All necessary files for the two systems are generated:

- for DVD-VR VR\_MAGR.IFO, VR\_MAGR.BUP, VR\_AUDIO.VRO;
- for DVD-Video VIDEO\_TS.IFO, VIDEO\_TS.BUP and possibly VIDEO\_TS.VOB.

**[0014]** However, the kernel AV stream (audio/video stream) that is described by the files VTS\_xx\_y.VOB for the DVD-Video system and VR\_MOVIE.VRO and VR\_STILL.VRO for the DVD-VR system, is the same bitstream, i.e. physically the DVD-Video and DVD-VR bitstreams are by only one stream.

**[0015]** To provide such feature the bitstream must have specific properties. Some of these properties are compelling, other properties are optional.

A corresponding bitstream structure as depicted in Fig. 2 is optimised with respect to compatibility with DVD-Video and DVD-VR. Fig. 2 shows that the DVD-VR video object units (VOBU) are shifted with respect to the DVD-Video video object units: DVD-Video video object units begin with a navigation pack NV\_PCK whereas DVD-VR video object units end with a navigation pack NV\_PCK that represents the beginning of the next DVD-Video video object unit.

A navigation pack NV\_PCK is followed by a real-time data information pack RDI\_PCK, several video packs V\_PCK, several subpicture packs SP\_PCK, and several audio packs A\_PCK. NV\_PCK is used by DVD-Video only, RDI\_PCK is used by DVD-VR only, V\_PCK and SP\_PCK and A\_PCK are commonly used by DVD-Video and DVD-VR.

Mandatory properties are:

a) Navigation Packs NV\_PCK must point in the stream to the beginning of each VOB according to the DVD-Video standard, Part 3, Chapters 2.4.47, 4.6 and 5.2.2.

b) Real-time Data Information Packs RDI\_PCK must point in the stream to the beginning of each VOB according to the DVD-VR standard, Part 3, Chapters 2.4 and 5.4.4.

c) The MPEG Video stream must have such values for horizontal size only that are allowed for DVD-Video as well as for DVD-VR: 720, 704 and 352, but not 480 and 544 that are allowed in DVD-VR only, see DVD-Video standard, Part 3, Chapter 5.4.1.2 and DVD-VR standard, Part 3, Chapter 5.5.1.2.

d) In case an audio stream is to be accepted under DVD-VR for Still Picture (e.g. menus), it must have the stream number '1'. In case an audio stream is to be accepted under DVD-VR for normal video (i.e. not Still Picture), it must have the stream number '0' to keep compatibility with DVD-Video, Part 3, Chapter 5.2.4 and DVD-VR, Part 3, Chapter 5.3.3.

e) For Linear Audio streams (PCM streams) '0' and '1', quantisation\_word\_length = 00b (16 bits) is to be used only to keep compatibility with DVD-VR, see DVD-Video, Part 3, Table 5.2.4-1, Note 8 and DVD-VR, Part 3, Table 5.3.3-1, Note 8.

f) For Linear Audio streams (PCM streams) '0' and '1', audio\_sampling\_frequency = 00b (48 kHz) is to be used only to keep compatibility with DVD-VR, see DVD-Video, Part 3, Table 5.2.4-1, Note 9 and DVD-VR, Part 3, Table 5.3.3-1, Note 9.

g) To allow for DVD-Video and DVD-VR the common use of streams '0' or '1' for Linear Audio, only the values 0000b (mono) and 0001b (stereo) can be used for number of \_audio\_channels, see DVD-Video, Part 3, Table 5.2.4-1, Note 10 and DVD-VR, Part 3, Table 5.3.3-1, Note 10. Alternatively, if for DVD-Video only PCM audio streams having a stream number greater '1' are used, then also the value 1001b (dual mono) for number\_of\_audio\_channels of linear audio streams '0' or '1' can be used.

h) If a subpicture stream is to be handled under DVD-VR as well as DVD-Video, then it must have the stream number '0' to keep compatibility with DVD-VR, see DVD-Video, Part 3, Chapter 5.2.5 and DVD-VR, Part 3, Chapter 5.3.4.

**[0016]** From a) and b) it follows that no DVD-Video VOBUs exist that start with the same sector as a DVD-VR VOBUs. Correspondingly, the same is true for each DVD-VR VOBUs. Besides this, there exist sectors NV\_PCK in the stream that are used only from a DVD-Video system and sectors RDI\_PCK that are used only from a DVD-VR system, as mentioned above.

**[0017]** Optional properties are:

A) The use of audio streams having stream numbers > 1. Such audio streams can be decoded by DVD-Video players only and may therefore fully match the DVD-Video standard specification, i.e. there is no limitation of allowed features due to DVD-VR requirements.

B) The use of subpictures having stream numbers > 1. Subpicture streams having a stream number > 0 can be decoded according to the DVD-Video standard only.

C) The use of audio streams having stream numbers > 1. More than one audio stream may exist. However, audio stream numbers '0' and '1' must not co-exist in parallel in a DVD-VR VOBUs in order to avoid conflicts with DVD-VR.

D) For Linear Audio (PCM) streams having stream numbers > 1, the parameters quantization\_word\_length, audio\_sampling\_frequency and number\_of\_audio\_channels may correspond to all possible values given in the DVD-Video standard DVD-VR. There is no limitation of allowed values due to DVD-VR requirements.

E) For audio streams having a stream numbers > 1 all audio formats are allowed that are supported by the DVD-Video standard, e.g. DTS coding format. There is no limitation due to DVD-VR requirements.

F) The MPEG Video stream may use for horizontal\_size the values 480 and 544 that are allowed for DVD-VR, if the corresponding video packs are used by DVD-VR VOBUs only, but not by DVD-Video VOBUs, see DVD-Video specification, Part 3, Chapter 5.4.1.2 and DVD-VR specification, Part 3, Chapter 5.5.1.2.

G) In user\_data() fields in the picture layer of video streams teletext information corresponding to the DVD-VR specification may be contained. Such user data fields could contain for example subpicture information, the content of which subpicture information would be identical with the content of a second subpicture stream.

**[0018]** The bitstream structure depicted in Fig. 3 is more complex than that depicted in Fig. 2. In the VOBUs there are several additional subpicture and audio packs assigned to further stream numbers '1' to '4'. However, only the subpicture and audio packs that are assigned to stream '0' are used by a DVD-VR device. This specific bitstream structure is less compatible with DVD-VR, but emphasises the specific features of DVD-Video and DVD-VR.

**[0019]** In a further embodiment of the invention the kernel AV stream contains, beside the above described part common to DVD-VR and DVD-Video, a specific part or specific parts that are used for DVD-VR and DVD-Video only and to which the corresponding root directories, i.e. said first or second main overhead data, facilitate access.

**[0020]** Fig. 4 shows an optical disk D, which is driven by a motor M and from which data are read by means of a pick-up P. These data are fed in conditioned form, for example after amplification and error correction, to a track buffer TB via an input DMA (direct memory access) controller IDMA. The data are stored in buffer TB in order to compensate for instantaneous or short-term data rate variations. The corresponding partial data streams of the buffer-stored data stream are re-copied from the track buffer TB in each case into an associated decoder: a video decoder VID for MPEG video data, an audio decoder AUD for MPEG or AC3 audio data, and a subpicture decoder for subpicture data. Such decoders require a dedicated bit buffer in order to access specific data in a specific order at specific time instants. Therefore, the data for a data decoder must be available in the output data stream in a combination and/or order that possibly differs from the input data stream. Since current device architectures may demand a decoder bit buffer comprising a single coherent memory area, the data initially stored in the track buffer can be re-copied

into the bit buffer for the respective decoder by means of an output DMA controller ODMA in the required order and at the required time instant. IDMA, ODMA and other stages can be controlled by a common processor  $\mu$ P or by separate processors. In a DVD-VR player the sub-picture decoder may be replaced by a teletext decoder. A DVD-VR recorder will additionally include corresponding video, audio and teletext encoders and means for writing encoded bitstream data on disc D.

**[0021]** The bitstream can be stored for example on a DVD-RAM or DVD-RW or DVD+RW or DVD-R or DVD-ROM disc, or can have the corresponding format. Instead of a DVD disc, any other storage medium can be used. It is also possible to send a bitstream according to the inventive data structure from a transmitter to a receiver, which decodes the received bitstream according to one or the other DVD system type.

**[0022]** A further feature is to decode such received or replayed bitstreams according to both DVD system types, thereby using the particular features of the DVD-Video format, e.g. of having up to 32 sub-pictures, together with the particular features of the DVD-VR format, e.g. teletext.

## Claims

1. Method of evaluating for the purpose of decoding a bitstream having a data structure fulfilling the requirements of a first data structure standard, the data of which bitstream include first main overhead data (VIDEO\_TS) and multiple data units (DVD Video VOB, DVD\_VR VOB), each data unit containing first data unit overhead data (NV\_PCK) according to said first data structure standard and encoded video data (V\_PCK) and encoded or non-encoded audio data (A\_PCK), **characterised** in that:
  - said bitstream additionally includes second main overhead data (DVD\_RTAV) such that said data structure of said bitstream fulfils also the requirements of a second data structure standard that is different from said first data structure standard;
  - said data units (VOB) additionally contain second data unit overhead data (RDI\_PCK) according to said second data structure standard;
  - said encoded video data (V\_PCK) and said encoded or non-encoded audio data (A\_PCK) are common to said first and second data structure standards;
  - when inputting (D, P, TB) said bitstream to a device operating on the basis of said first data structure standard, evaluating said first main overhead data and said first data unit overhead data of said data units (VOB), and decoding (VID, AUD) said encoded video data and decoding or processing, respectively, said encoded

ed or non-encoded audio data, but not evaluating said second main overhead data and said second data unit overhead data of said multiple data units,

or

when inputting (D, P, TB) said bitstream to a device operating on the basis of said second data structure standard, evaluating said second main overhead data and said second data unit overhead data of said data units (VOB), and decoding (VID, AUD) said encoded video data and decoding or processing, respectively, said encoded or non-encoded audio data, but not evaluating said first main overhead data and said first data unit overhead data of said multiple data units.

2. Method according to claim 1, wherein said first data structure standard is the DVD-Video standard and said second data structure standard is the DVD-VR standard.
3. Method according to claim 1 or 2, wherein said data units (DVD\_Video VOB, DVD\_VR VOB) additionally contain subpicture data (SP\_PCK) that are common to said first and second data structure standards, which subpicture data can be evaluated and processed in either one of said devices operating on the basis of said first or second data structure standards.
4. Method according to claim 3, wherein said data units (DVD\_Video VOB, DVD\_VR VOB) contain additional encoded audio data and additional subpicture data corresponding to only said first data structure standard, which additional data can be evaluated and decoded or processed, respectively, only in said device operating on the basis of said first data structure standard.
5. Method according to any of claims 1 to 4, wherein said bitstream contains, beside said common encoded video data (V\_PCK) and said common encoded or non-encoded audio data (A\_PCK), a specific part or specific parts that correspond to said first or second data structure standard, respectively, to which specific part or parts only said first or second main overhead data, respectively, facilitate access.
6. Method according to any of claims 1 to 5, wherein said bitstream is stored on an optical disc (D), for example a DVD-RAM or DVD-RW or DVD+RW or DVD-R or DVD-ROM disc.
7. Apparatus for evaluating for the purpose of decoding a bitstream having a data structure fulfilling the requirements of a first data structure standard, the

data of which bitstream include first main overhead data (VIDEO\_TS) and multiple data units (DVD\_Video VOB, DVD\_VR VOB), each data unit containing first data unit overhead data (NV\_PCK) according to said first data structure standard and encoded video data (V\_PCK) and encoded or non-encoded audio data (A\_PCK), wherein said apparatus operates on the basis of said first data structure standard and wherein:

- said bitstream additionally includes second main overhead data (DVD\_RTAV) such that said data structure of said bitstream fulfils also the requirements of a second data structure standard that is different from said first data structure standard;
- said data units (VOB) additionally contain second data unit overhead data (RDI\_PCK) according to said second data structure standard;
- said encoded video data (V\_PCK) and said encoded or non-encoded audio data (A\_PCK) are common to said first and second data structure standards, said apparatus including:
  - means (M, P, IDMA) for inputting said bitstream;
  - means (TB,  $\mu$ P, VID, AUD) for evaluating said first main overhead data and said first data unit overhead data of said data units, and for decoding said encoded video data and decoding or processing, respectively, said encoded or non-encoded audio data, but not evaluating said second main overhead data and said second data unit overhead data of said multiple data units.

8. Apparatus according to claim 7, wherein said first data structure standard is the DVD-Video standard and said second data structure standard is the DVD-VR standard.

9. Apparatus according to claim 7, wherein said first data structure standard is the DVD-VR standard and said second data structure standard is the DVD-Video standard.

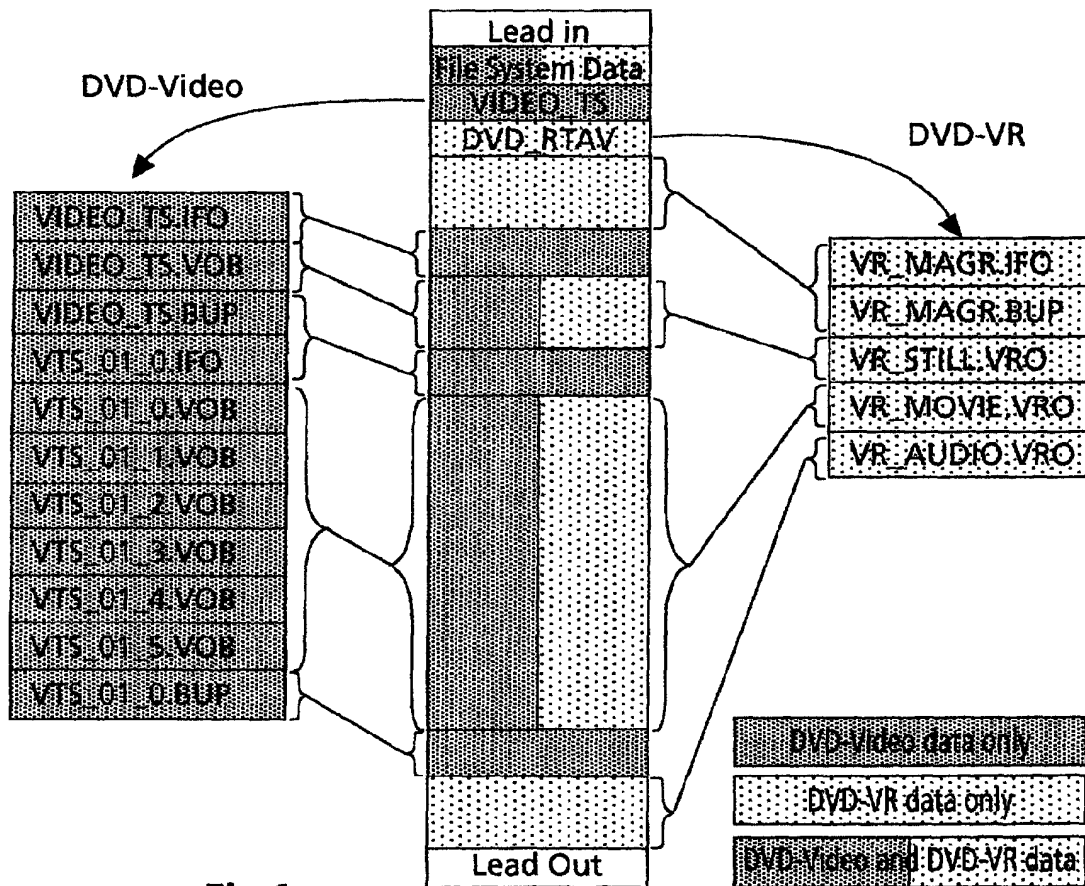
10. Method of assembling a decodable bitstream having a data structure fulfilling the requirements of a first data structure standard, the data of which bitstream include first main overhead data (VIDEO\_TS) and multiple data units (DVD\_Video VOB, DVD\_VR VOB), each data unit containing first data unit overhead data (NV\_PCK) according to said first data structure standard and encoded video data (V\_PCK) and encoded or non-encoded audio data (A\_PCK), **characterised** in that:

- said bitstream additionally includes second

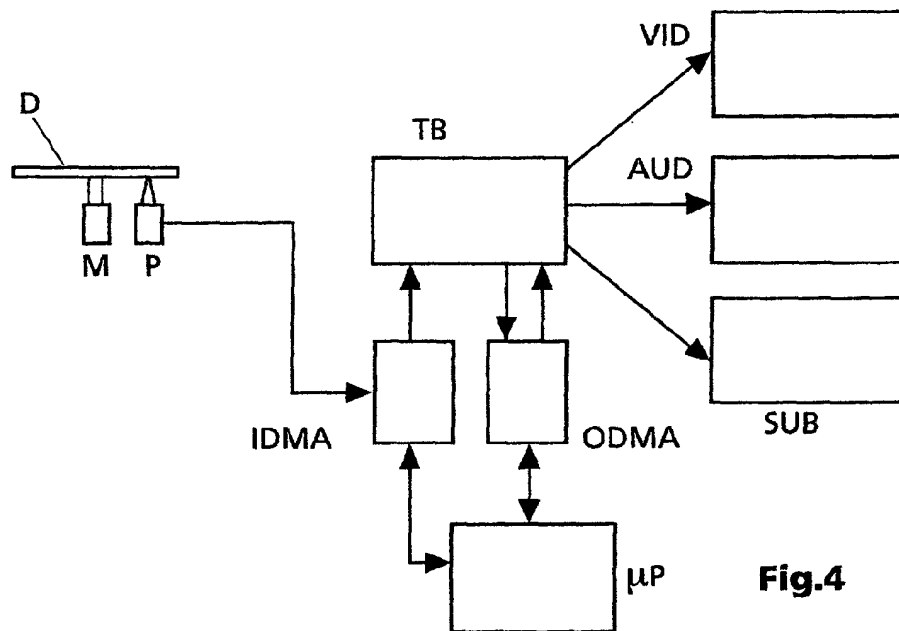
main overhead data (DVD\_RTAV) such that said data structure of said bitstream fulfils also the requirements of a second data structure standard that is different from said first data structure standard;

- said data units (VOB) additionally contain second data unit overhead data (RDI\_PCK) according to said second data structure standard;
- said encoded video data (V\_PCK) and said encoded or non-encoded audio data (A\_PCK) are common to said first and second data structure standards.

11. Storage medium (D), for example an optical disc, containing or having recorded on it a bitstream having a data structure as defined in claim 1, or which bitstream was assembled according to claim 10, wherein, when said bitstream of said storage medium is input into an apparatus according to claim 7, data from said bitstream cause carrying out a method according to claim 1.



**Fig.1**



**Fig.4**

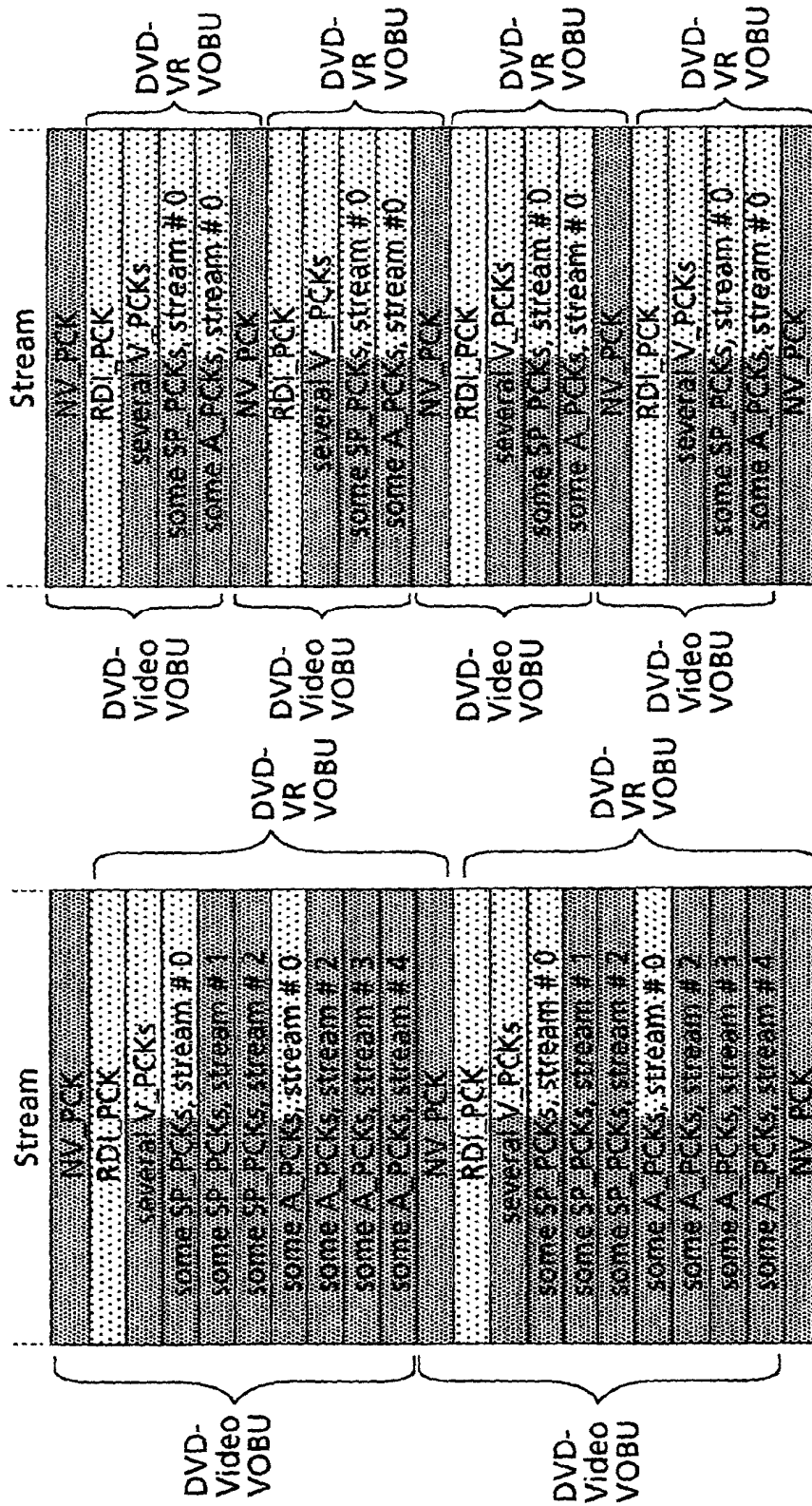
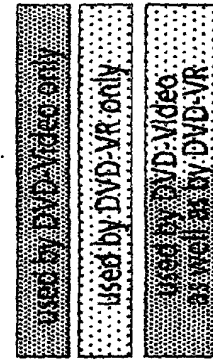


Fig.2

Fig.3





European Patent  
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# EUROPEAN SEARCH REPORT

Application Number  
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The present search report has been drawn up for all claims			
Place of search <b>THE HAGUE</b>		Date of completion of the search <b>19 March 2001</b>	Examiner <b>Daalmans, F</b>
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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